Although the muscle is unstriped, it acts quicker than the iris. Accommodation is paralysed by atropin in fishes, but not in cephalopoda.

Even deep-sea fishes, living at a depth where the light does not affect a photographic plate exposed for a whole day, possess an accommodating apparatus.

Amphibians that accommodate, usually do so for near objects; not, however, like most other animals, by altering the curvature of the lens, but by increasing the distance between retina and lens through contraction of the ciliary muscle. This muscle is unstriped, and the rate of accommodation is slow.

Accommodation is altogether absent in frogs. In these, too, the curvature of the cornea is so great, that in water the hypermetropia, for which no correction exists, is as high as twenty-five diopters. Toads, which can more easily than frogs catch worms and near still objects, possess a slight power of accommodation.

Serpents accommodate in a similar manner, but quicker, because instead of a ciliary muscle, which is generally absent, they possess a striped circular muscle inserted in the attachment of the iris. Contraction thereof presses forward the lens, without altering its curvature, towards the cornea. This mechanism of accommodation increases the pressure in the posterior chamber, and is consequently destroyed by opening the latter.

Accommodation is in all such cases effected by *relaxation*, as originally asserted by Helmholtz, not by increased tension, of the suspensory structures of the lens. By this action it becomes more spherical and of shorter focus. This change can be seen to have taken place in some animals even after removal of the supporting ligaments.

Of Amphibians many have a range of accommodation from ten to fifteen diopters. In animals of nocturnal habits accommodation is least developed. It is in birds that it reaches its highest perfection. Crampton's muscle is here the chief factor in producing relaxation, the inner layer of the cornea being pulled *back*, and not the parts behind the ciliary region forward, as in mammals, where the choroid is pulled forward.

It has been supposed that tightening the zonula caused increased pressure in the vitreous, and thereby increased the curvature of the front surface of the lens. Since, however, electrical stimulation of the enucleated cat- or monkey-eye produces nearly identical results, whether the bulb be intact or cut into (in the latter case there can be no increased pressure in the vitreous), this theory can hardly be correct.

Man has the greatest range of accommodation. After him come monkeys (up to ten diopters), then cats and other beasts of prey, and seals. Larger-eyed animals accommodate at a greater distance, but through a lesser range than man. Horses can also accommodate. But many animals, *e.g.* dog, use their noses rather than their eyes to examine near objects.

The anatomical investigations of Hess and Heine have confirmed most of these ophthalmosopic and experimental results.

Thus the two historical inventions of Helmholtz, the ophthalmometer and the ophthalmoscope, are invaluable not only to ophthalmology, but also to comparative physiology.

NOTES.

THE first of the two annual soirées of the Royal Society will be held on Wednesday, May 3. This is the soirée to which gentlemen only are invited.

THE Deputy-Master of the Trinity House, with a committee of Elder Brethren, accompanied by Lord Rayleigh, their scientific adviser, and Captain the Hon. F. C. P. Vereker, of the Board of Trade, arranged to leave London yesterday for Dover, with the object of making an official inspection of the wireless telegraphy system as experimentally in operation between the South Foreland lighthouse and the East Goodwin light vessel.

REUTER'S correspondent at Buenos Ayres reports that despatches received from Punta Arenas, Patagonia, announce the arrival there of the *Belgica* with the members of the Belgian Antarctic Expedition, under the command of Lieutenant de Gerlache. The *Belgica* is said to have remained fast in the ice for two months.

LORD RAYLEIGH and Prof. G. H. Darwin have been elected honorary members of the New York Academy of Sciences.

DR. T. J. J. SEE, who was recently appointed professor of mathematics in the U.S. Naval Observatory, has been nominated as chief of the American Nautical Almanac Office.

PROF. MILNE-EDWARDS, director of the Paris Natural History Museum, and president of the Geographical Society, has received the Grand Cross of the Swedish Order of the Polar Star from King Oscar II.

MR. J. STANLEY GARDINER, Balfour student of the University of Cambridge, and Mr. L. Borradaile have gone to the Island of Minikoi, situated between the Maldive and Laccadive Islands, to study the formation of coral reefs with special reference to the depth at which the reef-building coral organisms live, the food of the coral polyps, the influence of currents upon coral formations and upon the distribution of life near them, and the inter-relationship existing between the various organisms which occur on a coral reef. It is also proposed to survey the Maldive Islands with a view to obtaining information as to their mode of formation. Mr. C. F. Cooper will join the expedition during the summer.

SIR JOHN LUBBOCK, in a letter to Monday's *Times* on the Government Telephone Bill, draws attention to a point that is often lost sight of. He points out that if the telephone becomes national property, not only will the State lose money, but "the results as regards the progress of applied science will, in my judgment, be even more disastrous. Those who have hitherto devoted thought and time, energy and capital, to apply the results of scientific discovery to practical purposes are now told, that while, of course, if their enterprise does not pay, they must bear the loss, on the other hand, if it succeeds, Government will pass an Act of Parliament to deprive them of any advantage." In support of this opinion he quotes the late Mr. Varley as follows:—"The introduction of protectionism in so important an industry as telegraphy has given the postal executive a grip hold of applied electricity, and has enabled them to crush practically out of existence pioneers in telegraphy and applied electricity. English telegraph enterprise no longer exists, and America, which twenty years ago was electrically in the rear of this country, is now England's teacher. At the present time not only does she take premier rank in dynamo-electric developments, but practically all the telegraphic advances which have been made since the passage of the Telegraph Act have originated from American genius." . . . "The sole object I have in view in writing is to bring home to the British public, if I can, the evil consequences of the un-English retrograde policy of converting applied science into a Government trading monopoly." This point should engage the attention of the Society of Telegraph Engineers.

A FEW facts with regard to irrigation in India were mentioned by Lord Curzon on Monday, in replying to an address of welcome from the people of Lyallpur, a new town founded as a result of the Chenab irrigation scheme. The Viceroy pointed out that four years ago Lyallpur, now a flourishing township and mart for agricultural produce, was a barren, uninhabited jungle. In six years 1,000,000 acres have been brought under cultivation at a capital outlay of 1,500,000*l.*, while the net revenue for the last year was 16 lakhs of rupees, or a return of nearly 7½ per cent. of the capital expended. It is now estimated that the total value of the crops in a single year equals the capital cost of the entire works. At the present time in the Punjab alone 9500 miles of main and branch canals have been constructed, not including 10,500 miles of small distributaries. The total area irrigated by these means, which in 1868 amounted only to 1,000,000 acres, in 1878 to 1,300,000 acres, and in 1888 to 2,300,000 acres, has risen, owing to the startling progress of the last decade, to 5,200,000 acres. These figures form a striking testimony to British philanthropy, organising power, and engineering skill.

THE sixty-seventh annual meeting of the British Medical Association will be held at Portsmouth on August 1-4. The present President is Sir Thomas Grainger Stewart; and the President-elect is Dr. John Ward Cousins. An address in medicine will be delivered by Sir Richard Douglas Powell, Bart.; and an address in surgery will be delivered by Prof. Alexander Ogston. The scientific business of the meeting will be conducted in twelve sections—namely medicine, surgery, obstetrics and gynæcology, State medicine, psychology, anatomy and physiology, pathology, ophthalmology, diseases of children, pharmacology and therapeutics, laryngology and otology, and tropical diseases.

THE Liverpool Marine Biology Committee have arranged their usual Easter party for dredging and other zoological work at the Port Erin Biological Station. The station will be full of workers during not only the present week, but throughout April. In addition to members of the committee there are students from Liverpool, Manchester, Cardiff, Newnham and other colleges. The Lancashire Sea Fisheries steamer is at Port Erin, and several days will be spent in trawling and tow-netting in the deep water between the Isle of Man and Ireland. A long hose-pipe and pump will be used for obtaining plankton from the bottom waters, and a closing tow-net will also be tried. Another section of the work consists in the collection of fish spawn for the Lancashire hatchery. The hatching boxes at present contain over four million developing embryos of plaice and cod.

IN view of the visit of the British Association to Glasgow in 1901, an effort is being made to draw up complete lists of the fauna, flora, and geological features of the Clyde district. A natural history sub-committee has been formed, the Convener being Prof. John Young; Vice-Convener, Prof. Malcolm Laurie; and Secretary, Rev. G. A. Frank Knight, Almanarre, Garelochhead. A leaflet, showing the scheme of work that has been sketched out, has been prepared with the hope of obtaining help from various quarters to assist the different compilers in their labours. Information is specially desired as to (1) distribution of species; (2) papers in magazines, journals, and transactions of societies, which might otherwise be overlooked; and (3) names of workers in the different departments who might be willing to assist. The scope of the inquiry, as arranged by the committee, is "the natural drainage area of the Clyde, and of all the sea lochs which form extensions of its estuary." The northern limit, therefore, is the watershed beyond the head of Loch Fyne, and the southern boundary has been defined as a line drawn between the Mull of Cantire and the most southerly point of Ayrshire. Further information can be obtained from the Secretary.

WE learn that some recognition will shortly be made of the invaluable services rendered to geological science by the Rev. Thomas Wiltshire, Professor Emeritus of Geology in King's College, London. Of late years Mr. Wiltshire's labours have not been of a nature to bring his name prominently before the public, but he has been toiling quietly as the honorary secretary and editor of the Palæontographical Society. That Society has now published fifty-two quarto annual volumes, and some thirty of these have, we believe, been edited by Mr. Wiltshire. These volumes each contain forty or fifty plates of fossils, and two hundred or more pages of letter-press, dealing with organic remains of all classes. The interest attaching to these volumes is world-wide, and so is their reputation. Immense credit is undoubtedly due to Mr. Wiltshire, and it is pleasing to learn that the members of the Palæontographical Society (of whom Dr. Henry Woodward, F.R.S., is president, and Mr. R. Etheridge, F.R.S., treasurer) have decided to present him with a testimonial, towards which subscriptions (not limited to members of the Society) are now being received.

A FEW particulars as to the progress which is being made by the Royal Commission on Sewage Disposal are given in the *Lancet.* It is stated that, in addition to hearing evidence and visiting a number of sewage works, the Commission have been engaged in determining a number of important questions relating to the desirability or not of laying down chemical and bacteriological standards which should be obtained by effluents, whether in the case of domestic sewage only or of such sewage combined with trade refuse. For this purpose they have employed experts of their own, and it is understood that the staff of chemists and bacteriologists has just been increased, so that the effluents from works of different character can be systematically studied, almost hourly by day and by night, under varying conditions of temperature and rainfall. No statement can as yet be made as to the term over which these experiments must extend; but it is quite clear that they are at present only in an initial stage, and that, in so far as bacteriological results are concerned, the Commission are dealing with a subject as to which little expert evidence is available, and that the matter will have to be examined very deliberately and exhaustively before useful inferences can be drawn. These experiments are being carried out under the supervision of a committee of the Royal Commission, consisting of Sir Richard Thorne, F.R.S., Prof. Michael Foster, F.R.S., and Prof. Ramsay, F.R.S.

A PAPER, by Mr. W. C. Peckham, in the April number of the *Century*, on the liquefaction of gases in general, and the work of Prof. Dewar and Mr. Charles E. Tripler, of New York, in particular, contains some remarkable pictures of experiments with liquid air. The method used by Mr. Tripler to liquefy air is the same as that employed by Dr. Linde and Dr. Hampson. Air is compressed to between two thousand and three thousand pounds per square inch, and cooled by water flowing round the pipes containing it. As it escapes it expands, and is therefore cooled, and this colder air is made to pass around the pipes so as to reduce the temperature of the air in them. The result of this self-intensification is a continual reduction of temperature within the pipes until the temperature of liquefaction, $-312°$ Fahr., is reached. A laboratory form of this apparatus produces from thirty to forty gallons of liquid air in ten hours. In fifteen minutes after the engine is started liquid air can be drawn off. A number of experiments, many of which exemplify results obtained by Prof. Dewar, are described and illustrated in the article. One of the most striking experiments is performed by placing over a cool fire a tea-kettle containing some liquid air. "The heat of the fire evaporates the liquid, and a stream of vapour of air shoots out of the spout to a great height. It looks like steam from a kettle of boiling water. In a very short time water poured into the kettle may be taken out as ice, and the bottom of the kettle is found to be coated with solid carbonic acid frozen from the fire, which glows intensely a hand's breadth away. Yet liquid air will boil with apparently the same violence if set upon a cake of ice." Popular knowledge of the phenomena of liquid air in America is due almost entirely to Mr. Tripler, whose experiments with gallons of liquefied air have excited considerable interest.

THE remarkable discoveries, made in the first place by Japanese botanists, respecting the mode of fertilisation in Gymnosperms, have been followed up by two further papers published in the *Journal of the College of Science* of Tokyo (vol. xii., parts 2 and 3). Prof. Hirasé gives (in French) a further contribution to our knowledge of the impregnation and biology of *Gingko biloba* (*Salisburia adiantifolia*); and Prof. Ikeno (in German) a further account of the development of the sexual organs and the process of impregnation in *Cycas revoluta*. The mature pollen-grain of *Gingko* consists of three cells of unequal size; the largest is the vegetative cell; a small intermediate cell is the antheridial cell; the smallest exterior cell is inactive. From the largest of these cells is produced the pollen-tube, which branches and spreads over the surface of the nucellus. The intermediate cell divides into a body-cell and a stalk-cell; the contents of the body-cell again divide into two antherozoids, their formation being accompanied by the appearance of attraction-spheres. In the formation of the archegone of *Cycas* three periods may be distinguished—the "primordium" (*Anlage*) period, the period of growth, and that of maturity. The pollen-grain consists of two small prothallium cells and a large embryonal cell. Shortly after pollination the pollen-grain produces a tube. The inner prothallium-cell divides into a body-cell and a stalk-cell: in the former appear two centrosomes. Shortly before impregnation the nucleus of the body-cell, or spermatogenous cell, divides into two nuclei, and the cell itself into two spermatids. The nucleus of each spermatid forms an antherozoid, with a nucleus, and a tail composed of cytoplasm. In the nucleus of the oosphere is a crater-like cavity, which the antherozoid enters, in order to fuse with the nucleus of the oosphere.

FROM a paper by Mr. E. S. Salmon on the genus *Fissidens* in the *Annals of Botany*, we learn that the following is the geographical distribution of this genus of mosses, the first number in each case being the total number of species, and the second the number of endemic species:—Europe, 32, 13; Asia, 92, 84; Africa, 159, 140; North America, 74, 49; South America, 118, 106; Pacific, 60, 50.

WE learn from the Allahabad *Pioneer Mail* that Dr. Stein, the learned Principal of the Oriental College at Lahore, has published, through the Punjab Government Press, a detailed report of the results of his examination of the archæological remains in Buner. Dr. Stein accompanied Sir Bindon Blood's force in the expedition to the Buner country in December 1897, and had a unique opportunity of investigating the ruins, rock sculptures, and inscriptions of a portion of the ancient Udyana which had previously been inaccessible to scholars. The monograph is certain to be read with great interest by archæologists both in India and in Europe.

SOME interesting statistics with reference to the seal and whale fishery in 1898 are given by Mr. Thomas Southwell in the *Zoologist* for March. The total number of seals taken by the fleet of eighteen steamers, of the aggregate capacity of 5595 tons, and manned by 3802 seamen, which left St. John's, Newfoundland, in March 1898, for the Gulf fishery grounds, was 241,708, of a net value of about 80,000*l*., as compared with 126,628, valued at 32,564*l*., in the previous season. In addition to these, about 30,000 seals were taken by the sailing vessels and by the shore fishermen. Mr. Southwell states that the seal fishery in the Greenland seas, so far as the Dundee vessels are concerned, has practically become a thing of the past, and, such as it is, has almost drifted into the hands of the Norwegian vessels. Right whales were extremely scarce during the season; the absence of the whales from Greenland seas being attributed to fine weather and light ice. The bottle-nose whale fishery, which was once so productive, is now quite discarded by the British vessels. The total catch of the Dundee fleet in 1898 was 6 right whales, 984 white whales, 591 walrus, 779 seals, and 80 bears, yielding 297 tons of oil and 112 cwts. of bone.

THE United States Department of Agriculture has recently been devoting a good deal of attention to dietary studies amongst the poor in different parts of the country, and the Office of Experimental Stations has already issued quite a number of different bulletins on this subject. The most recent addition to the series is one on dietary studies in Chicago in 1895 and 1896. To obtain satisfactory statistics on this subject is by no means easy, for the data sought include the character, amount, and cost of food consumed during a given length of time, the age, sex, and occupation of the different members of the various families selected, the number of meals taken by each person, and, as far as possible, the financial and hygienic conditions of the family in question. To facilitate the conduct of an inquiry of so personal a nature, two ladies from the Hull Settlement, which is situated in a densely-populated district of Chicago, were asked, on account of their intimate acquaintance with the neighbourhood and inhabitants, to collect the information required. Families of Italians, French Canadians, Russian Jews (both orthodox and unorthodox), and Bohemians were chosen; whilst for comparison three American families were also included: in all, about fifty studies were carried through more or less satisfactorily. National prejudices and idiosyncrasies render living for foreigners more expensive in many instances than for natives, as, for example, is the case with Italians, who cannot be persuaded to exchange the imported oil, wine, and cheese for the far less costly food to be obtained in American cities. The result of the inquiry emphasises the need for education among the poorer classes, both in household management and cookery, and also in the selection of foods. Taste and cost are usually the only considerations to which attention is paid; the fact that foods vary greatly in nutritive value is rarely, if ever, recognised. In many cases families could obtain a more nutritious diet for the sum expended, or an equally nutritious diet for a smaller sum.

WE have received from Profs. A. Riccò and G. Saya a copy of the results of hourly simultaneous meteorological observations made at four stations between the Observatory at Catania (altitude 65 metres) and the Etna Observatory (altitude 2947 metres): the heights of the intermediate stations being respectively 705 and 1886 metres. The observations were only made on July 26–28, 1897, and March 27 and 28, 1898, so that we shall merely refer briefly to one or two of the general results. In July the diminution of temperature, with respect to altitude, was less between the two lower stations than between the upper ones; while in March the diminution was somewhat less, and much more uniform. In July the relative humidity decreased between the first and third stations, but increased between the third and fourth. In March there was scarcely any decrease between the first and second stations, and a considerable increase between the second and fourth stations. The same authors have sent us a copy of the results of observations of air and sea temperature, and of the colour of the water, in the Adriatic and Ionian Seas. The maximum temperatures, especially of the surface water, are nearly equal in the two seas, but the minima of the Adriatic are much lower than those of the Ionian Sea. These results are based upon observations made during one year.

Mr. J. Baxendell has sent us a copy of the report of the Fernley Observatory, Southport, for the year 1898. The observatory is maintained by the corporation of that town, and is one of the best equipped in the United Kingdom. Observations have been regularly taken at Southport for nearly thirty years, having been commenced by the late Mr. J. Baxendell (father of the present observer), who was a meteorologist of considerable repute. The results, it is almost unnecessary to say, show evidence of very careful work, and include, in addition to the usual elements, observations of sea-surface and underground temperature, evaporation, ozone, &c., and a useful table, containing comparisons with other health resorts, is appended to the report. All such stations vie with each other in giving good reports of bright sunshine. Southport possesses both the Campbell-Stokes burning recorder and the Jordan photographic recorder, and we are glad to see that the records of the latter are "fixed" before being measured. Possibly this is not done at all stations; when measured before "fixing" the results are somewhat exaggerated, as compared with those of the burning recorder. We should scarcely have expected the sunshine at Guernsey (where a photographic recorder is used) to have been greater than at Jersey.

We have received together the 13th and 14th reports of the State Entomologist of the State of New York for 1897 and 1898, on "Injurious and other Insects." The report for 1897, which was edited by the late Dr. J. A. Lintner, calls attention to the decline in the spread of the formidable San José scale, and deals briefly with a large number of insects, some few being noticed at greater length. The two plates represent *Tenthredo rufopectus*, Norton, and three species of *Uroceridae*, and the spines of the larva of *Eacles imperialis*, Drury (after Packard). The report for 1898 is edited by Dr. Ephraim Porter Felt, Acting State Entomologist. During that year much damage was caused to trees in America by the attacks of various caterpillars. The general character of this report is similar to that of the last; both are illustrated with woodcuts in addition to the plates, and both contain useful bibliographical notices relating to various insects discussed. The report for 1898 contains nine plates, several of which are devoted to illustrations of trees defoliated by caterpillars to an extent fortunately not often seen in Europe. The other plates illustrate various moths, caterpillars, *Coccidae*, and the cast skin of a *Tarantula*.

The seventh volume of the *Annalen der Sternwarte in Leiden*, published by the director of the observatory, Prof. H. G. van de Sande Bakhuyzen, contains four contributions, three of which, as we are told, have been previously distributed among some observatories. The first of these, by the director himself, is devoted to investigations on the period of rotation of the planet Mars, and to variations of his spots. The author has made use of all the available data, and finds that in Schrœter's and Herschel's time a very dark spot, similar in form to that of Syrtis Major, but fifty to fifty-five degrees distant from the latter, was situated in the region of Cyclopium. This, he says, indicates large variations in this part of Mars' surface. He is also led to adopt new values for the time of transit of the zero of longitude and the period of rotation, this value for the latter being 24h. 27m. 22·66s., with a mean error of ± 0·0132s. The second paper, also by himself, gives an account of an apparatus he has devised for determining the absolute personal equation of an observer in making transit observations. The chief part of the apparatus consists of a movable and fixed prism, the velocity of the former being known. By a simple arrangement of mirrors, the artificial star can be viewed in the transit instrument when the latter is set at any altitude. Prof. J. C. Kapteyn is the author of the third memoir, which deals with the determination of the parallaxes with the meridian circle; while the last paper contains the determination of the difference of longitude between Leyden and Greenwich, by Prof. H. G. van de Sande Bakhuyzen and his brother, Dr. E. F. van de Sande Bakhuyzen; the final value adopted for the difference of longitude being given as 17m. 55·891s.

Messrs. Dulau and Co. have issued a catalogue of book and papers on astronomy and meteorology offered for sale by them.

The twenty-ninth volume of the *Proceedings* of the London Mathematical Society has just been published in two parts. The volume contains papers read before the Society from November 1897 to November 1898; but as brief abstracts of these papers have appeared in our reports of Societies, it is unnecessary to do more now than announce their publication in a complete form.

The fifteenth edition of Kirkes' well-known "Handbook of Physiology," by Prof. W. D. Halliburton, F.R.S., has just been published by Mr. John Murray. The results of important researches in all branches of physiology have been incorporated, and the order in which the subjects are treated has been modified, the section on the central nervous system being now placed towards the end of the book. The additions and alterations will increase the value of the volume to teachers and students.—A second edition of "Chemistry for Photographers," by Mr. C. F. Townsend, has been published by Messrs. Dawbarn and Ward, Ltd.

The additions to the Zoological Society's Gardens during the past week include a Bay-thighed Monkey (*Cercopithecus ignatus*, ♂), a Green Monkey (*Cercopithecus callitrichus*) from Liberia, presented by Mr. J. F. Braham; a Lesser White-nosed Monkey (*Cercopithecus petaurista*) from West Africa, presented by Captain F. E. Bishop; a Cape Jumping Hare (*Pedetes caffer*) from South Africa, presented by Mr. W. Champion; a Vulpine Phalanger (*Trichosurus vulpecula*) from Australia, presented by Mr. S. Humble; a Pel's Owl (*Scotopelia peli*) from West Africa, presented by Lieut. E. V. Turner, R.E.; two Ravens (*Corvus corax*), European, presented by Mr. Francis Walpole; a Giraffe (*Giraffa camelopardalis*, ♂) from South-east Africa, two Elands (*Orias canna*, ♂ ♀) from the Transvaal, a Bless-bok (*Damaliscus albifrons*, ♂) from South Africa, deposited; a Red-faced Ouakari (*Ouacaria rubicunda*, ♀) from the Upper Amazons, a Naked-throated Bell-bird (*Chasmorhynchus nudicollis*), three Blue-bearded Jays (*Cyanocorax cyanopogan*) from Brazil, purchased.

OUR ASTRONOMICAL COLUMN.

Tuttle's Comet (1899 *b*).—

Ephemeris for 12*h*. *Berlin M.T.*

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